LQ search in eνjj channel

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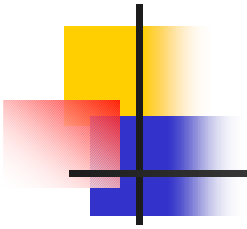
-Blessing-

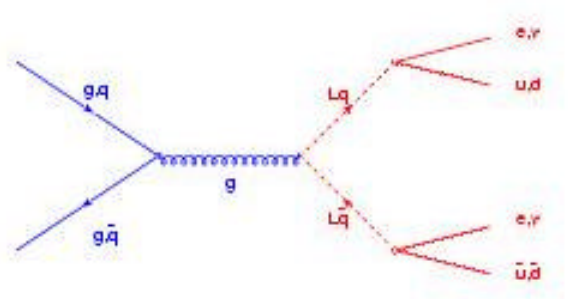


Introduction

- Some beyond the SM models assume additional symmetry between leptons and quarks
- LeptoQuarks – transition between leptons and quarks
  - Have both lepton and baryon numbers
  - λ - unknown coupling to leptons and quarks

LQ production at the TeVatron

- Production
  - qg → LQ + LQbar
  - gg → LQ + LQbar
  - qqbar → LQ + LQbar



- Decay
  - LQLQ → l^+l^-qq, $l^{\pm}nqq$, $nnqq$ β = Br(LQ->eq)
- Experimental signature:
  - High pt isolated leptons (and/or MET) + jets

LQ production at TeVatron

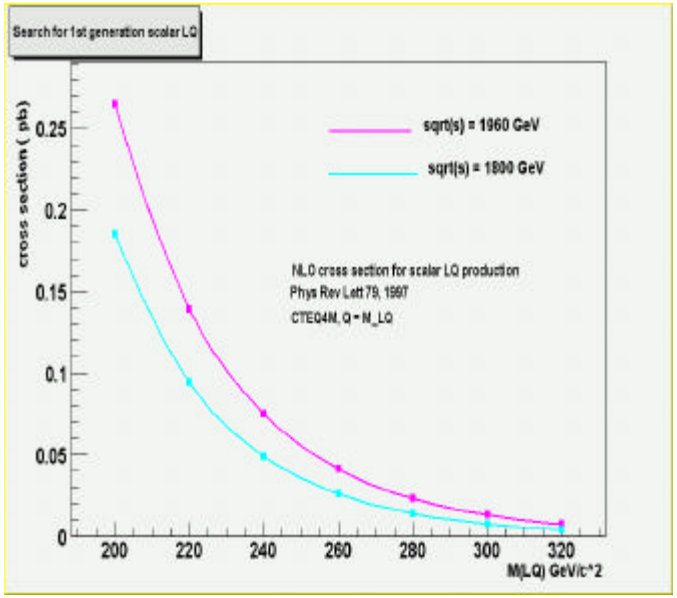
Code from Michael Kraemer (Phys.Rev.Lett 79,1997)

M_{LQ} (GeV/c^2)	σ(NLO) [pb]
200	0.185E+00
220	0.094E+00
240	0.489E-01
260	0.259E-01
280	0.138E-01
300	0.746E-02
320	0.401E-02

$\sqrt{s}$ = 1800 GeV
$Q^2 = M_{LQ}^2$
CTEQ4M pdf

M_{LQ} (GeV/c^2)	σ(NLO) [pb]
200	0.265E+00
220	0.139E+00
240	0.749E-01
260	0.412E-01
280	0.229E-01
300	0.129E-01
320	0.727E-02

$\sqrt{s}$ = 1960 GeV
$Q^2 = M_{LQ}^2$
CTEQ4M pdf



Previous results from Run I

- 1997
  - m(LQ) > 180 GeV/c^2
  - straightforward strategy
    - cut on transverse mass to get rid of W + 2 jets background
- June 2001
  - m(LQ) > 182 GeV/c^2
    - relative likelihood technique

LQ search in evjj

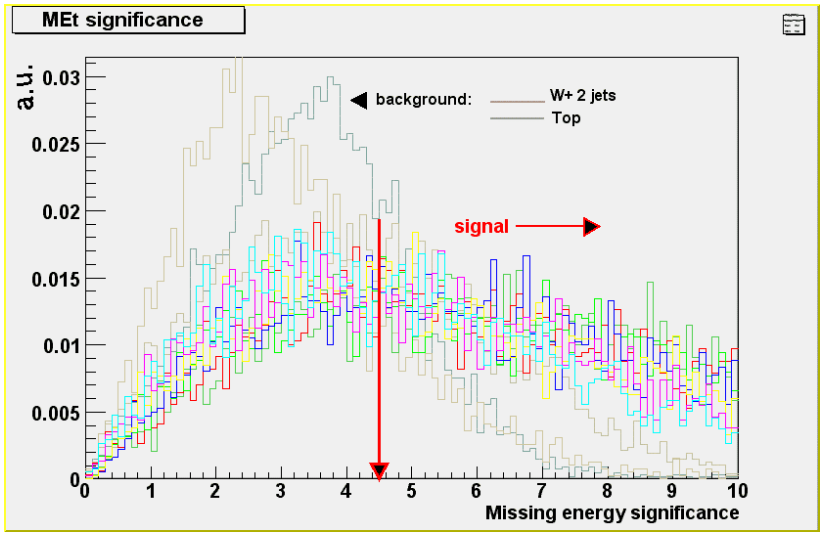
Signature: 1 electron, 2 jets and large MET

Analysis cuts

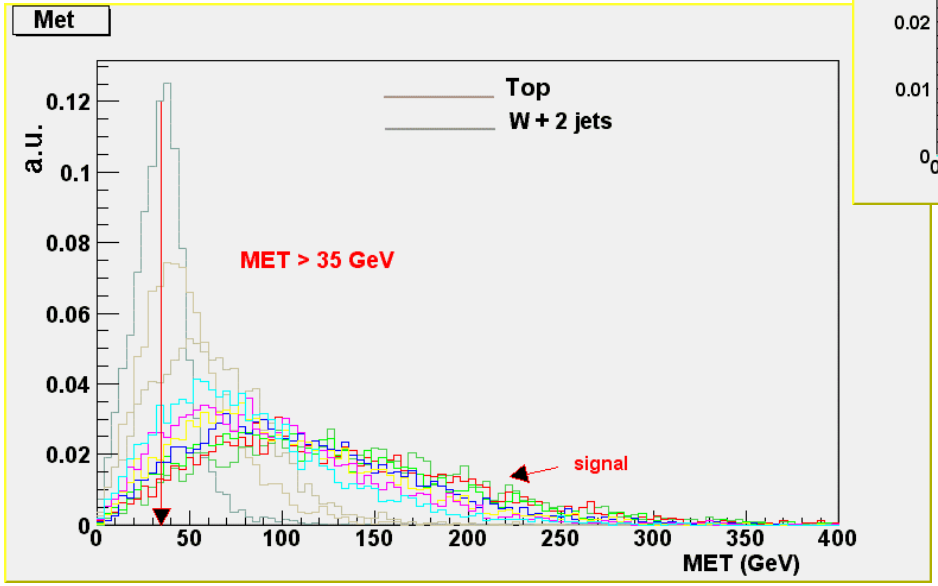
- 1central electrons with E_T > 25 GeV and MET > 35 GeV
- 2 jets with E_T > 30 GeV
- $\Delta\phi$ (MET-jet) > 10°
- $E_T(j1) + E_T(j2)$ > 80 GeV
- $M_T(e\text{-}\nu)$ > 120
- Met/$\sqrt{\Sigma E_T}$ > 4.5

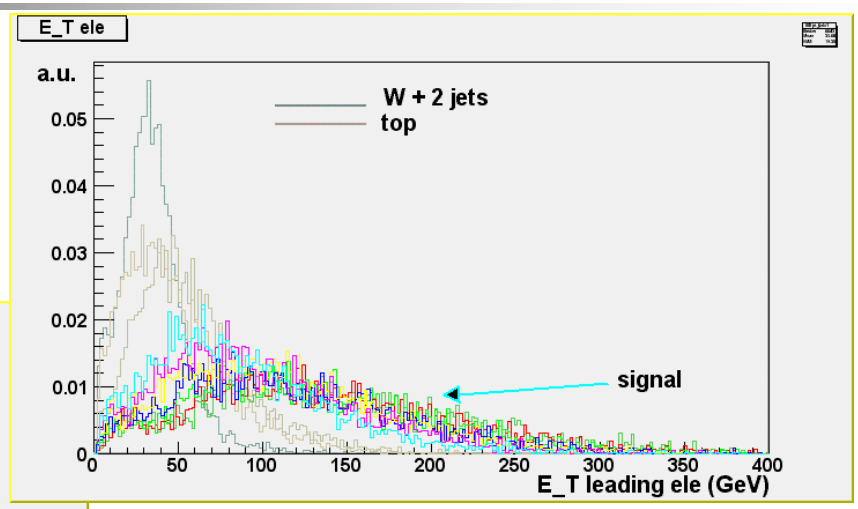
similar to note 4228, but for metSig cut

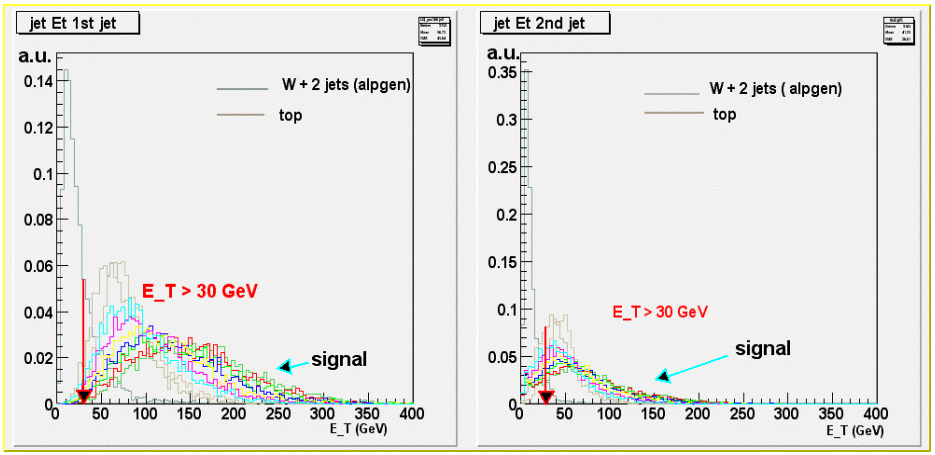
Events with 2 central electrons are rejected (to be orthogonal to eejj analysis)



MC distributions







Tools

- Signal generated and reprocessed with 4.9.1
  - 5000 events at masses from 160 to 280

Same as eejj

Efficiencies & acceptance

$$\varepsilon_{tot} = \varepsilon_{Acc}(M) \times \varepsilon_{ID} \times \varepsilon_{z0} \times \varepsilon_{trig}$$

- Trigger
  - Top/EW - as in Z` analysis we use 99.1±0.1%
- Efficiencies for electron selection cuts
  - Z' analysis - one tight electron efficiency
    - $\varepsilon_T = 89.6 \pm 0.5$
- Other
  - efficiency on the vertex cut ($|z_0| < 60$ cm)95.2 ± 0.1 (stat) ± 0.5 (sys)

Electron ID (Z' analysis)

- Central electron tight
  - $E_t \geq 25$ GeV
  - $p_t > 10$ GeV
  - hadem <= 0.055 + 0.00045 * E
  - E/p < 4 (for $E_T < 200$ GeV)
  - iso4e/emet < 0.1 (0.2 for second central loose)
  - |DeltaX | < 3.0
  - | DeltaZ | < 5.0 cm
  - Fiducial = 1
  - lshr < 0.2

$\varepsilon_T = 89.6 \pm 0.5\%$

Expected signal events

Number of expected events in 72 pb^{-1}

Mass (GeV/c^2)	n Theory CTEQ4M (pb) $Q^2 = M^2_{LQ}/4$	n Theory CTEQ4M (pb) $Q^2 = 4M^2_{LQ}$
160	7.1	6.2
180	4.8	3.8
200	2.8	2.3
220	1.7	1.4
240	0.99	0.8
260	0.6	0.5
280	0.34	0.3

Background

- tt with both W ->eν 0.13 ± 0.02 events
  - pythia
- tt decaying into l + jets 0.026 ± 0.012 events
  - pythia
- W + 2 jets
  - alpgen + PS 1.60 ± 1.10

Total 1.73 ± 1.47

Analysis results

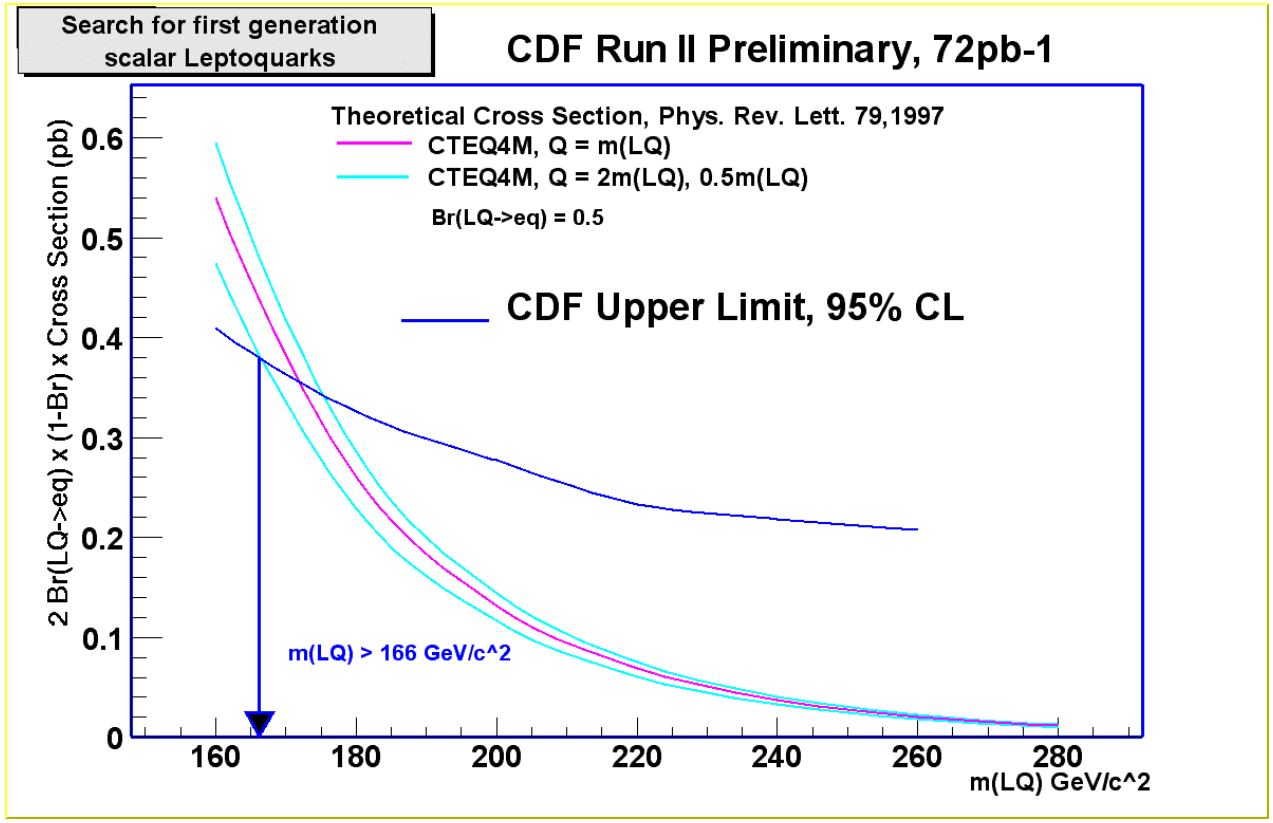
2 events survives the analysis cuts:

Number of events with 1 ele > 25 && MET > 35	26413
evt with 1 ele, MET and >= 2 jets (30 30)	241
evt with 1 ele, MET and >= 2 jets and dphi cut	196
evt with 1 ele, MET and >= 2 jets and dphi cut and 2jet_80	156
evt with 1 ele, MET and >= 2 jets and dphi cut and 2jet_80 and T mass cut	23
evt with 1 ele, MET and >= 2 jets and dphi cut and 2jet_80 and T mass cut and metsig	2

Systematic uncertainties

- Luminosity: 6%
- Acceptance
  - pdf 4.3% (from run I)
  - statistical error of MC 2.2%
  - jet energy scale (Level 3) 2.9 - 0.7 % (absolute uncertainty)
    - jets corrected for energy scale, time dependent and relative response
    - jet energy scaled of systematic uncertainty + 5% (energy scale + 5% data/MC adjustment); 0.08 to 0.01 systematic effect on signal acceptance
- Electron ID efficiency (Z')
  - statistical error of $Z \rightarrow e^+e^-$ sample: 0.8%
  - energy scale : 3.7%
- Event vertex cut : 0.5% (Willis)

Cross section Limit



M_{LQ} > 166 GeV @ 95% CL

Conclusions

- A preliminary 95% CL cross section lower limit as a function of M_{LQ}, for leptoquarks decaying with 100% branching ratio into eq ($\beta = 0.5$) has been set.
- Comparing it to the NLO theoretical predictions for leptoquark pairs production at the TeVatron, an upper limit on the Leptoquark mass is obtained at

$$m_{LQ} > 166 \text{ GeV}/c^2$$